Working with Spatial Data

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Agenda

Data....

- What is it?
- Why is it important?
- Where do I get it?
- What should I know about it?
- What do I do with it?
- What kind do I need?

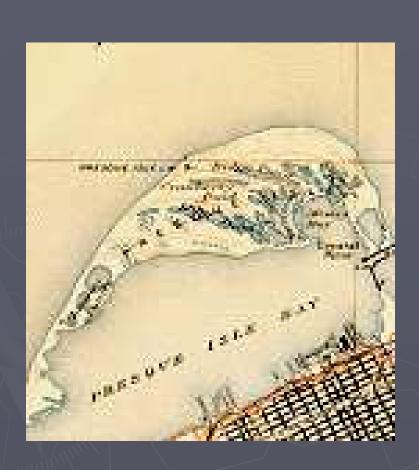
What are Spatial Data?

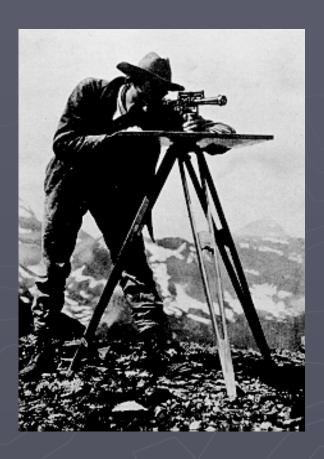
Information about the locations and shapes of geographic features and the relationship between them, usually stored as coordinates and topology

Characteristics

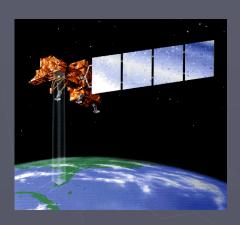
- Tied to locations on the Earth
 - Can be mapped
- Describe a wide variety of topics at a variety of scales (local to global)
 - •climatic
 - geophysical
 - biologic
 - geographic
 - socioeconomic

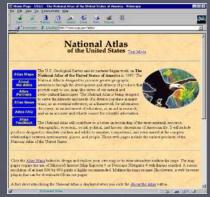
Where We Were

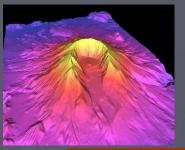




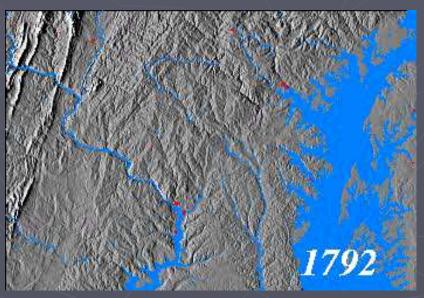
Where We Are Going













Spatial Data Trends

- 1. Increasing volume.
- 2. Increasing coverage.
- 3. Increasing detail.
- 4. Increasing partnerships.
- 5. Increasing user demands.
- 6. Delivery:

First, via media.

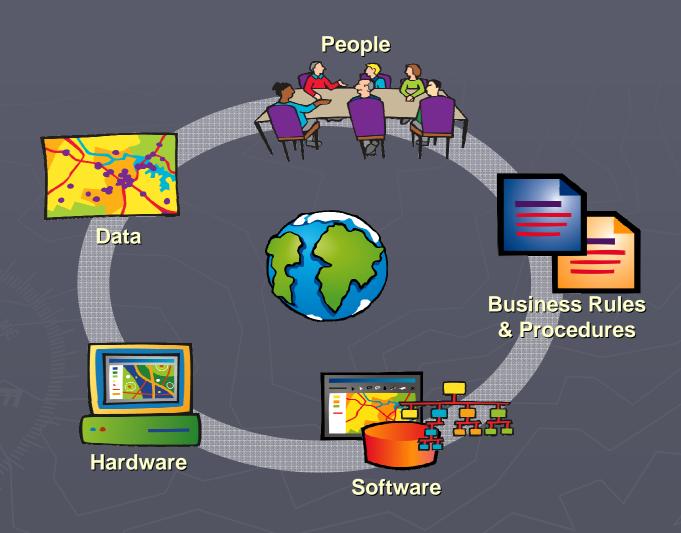
Then, via FTP over Internet.

Then, via map-based interfaces on web.

By knowing what information products you want, you can plan for the acquisition of the needed data.

-Roger Tomlinson

The Five Parts of a GIS System:



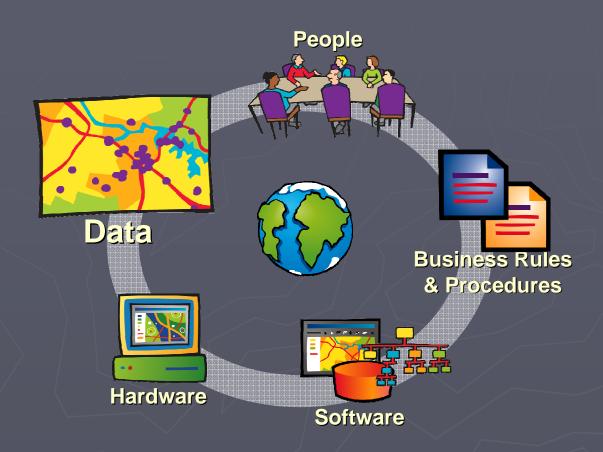
Building Your GIS System:

- You've got the people in place ...
- ► Your hardware is ready ...
- You've developed good procedures
- ➤ You have the software you need ...



Building Your GIS System:

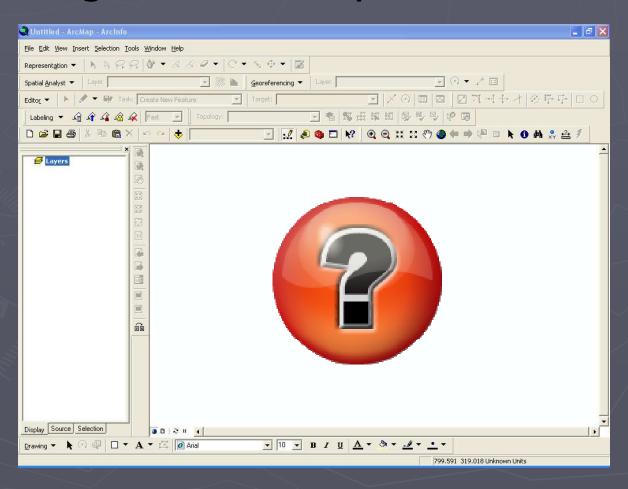
But ...
Without Data,
You Don't
Have a GIS!



Remember, Acquiring GIS Software Doesn't Automatically Give You a GIS System

The Problem

"How do I get data for my GIS"?



Ask Yourself These Questions:

- What do I want the GIS to do?
- What data does the GIS need in order to do it?
- Where can I find these data?

Secondary Questions

- ▶ What can you get that already exists?
- ▶ What can you create from existing sources?
- ▶ What levels of map accuracy and scale will you need?
- What about data format?

Where to Get Data?

- ► #1 Search the Internet
- Contact government agencies
- Search geospatial data portals
- Consider a GIS data vendor



Useful Keywords: GIS; Data; Download; Shapefile

Demo

Let's search the internet!

Consider this an adventure!

(PS...audience participation is required)

A FEW Common Data Sources

- Geography Network <u>www.geographynetwork.com</u>
- ► State Data Portals:
 - *Utah: http://gis.utah.gov/agrc
 - Colorado: http://coloradogis.nsm.du.edu/Portal/
 - Arizona: http://agic.az.gov/portal/main.do
 - New Mexico: http://rgis.unm.edu/
 - Wyoming: http://wgiac2.state.wy.us/html/index.asp
- ► GIS Data Depot (free and fee) http://www.geocomm.com/
- ► National Atlas: http://nationalatlas.gov/
- ➤ TerraServer-USA http://terraserver-usa.com/default.aspx
- ► USGS: The National Map Seamless Server http://seamless.usgs.gov/
- ► USDA: Geospatial Data Gateway http://datagateway.nrcs.usda.gov/
- Mapdex http://www.mapdex.org/search/
- US Census Bureau Boundary Files http://www.census.gov/
- US Census Bureau's Factfinder http://factfinder.census.gov
- ESRI Education Community http://edcommunity.esri.com/data/download/
- Lots and lots and lots and lots and lots more!

Why use state and federal data sets?

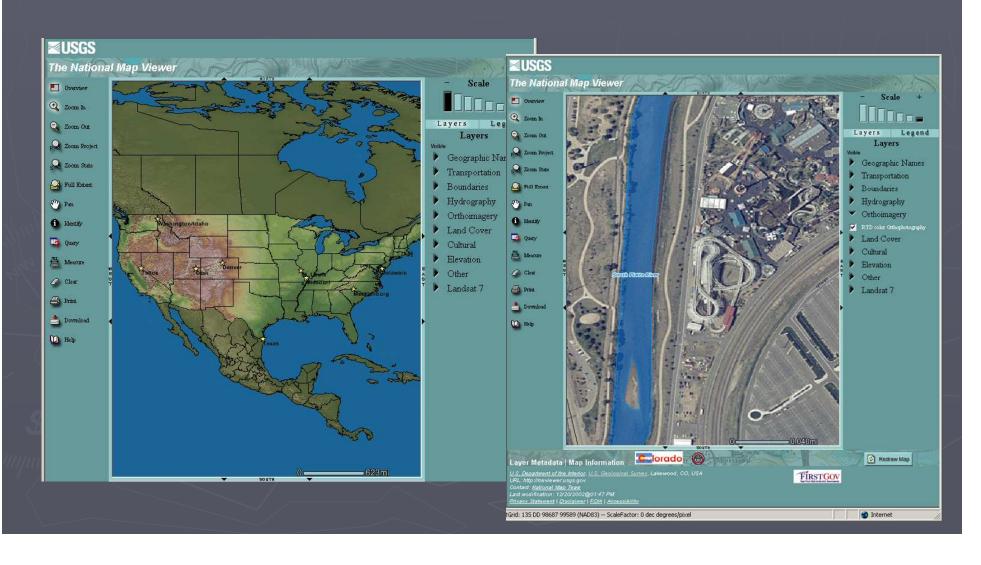
- Data usually free or inexpensive.
- Data usually accurate and according to national map accuracy standards.
- Good spatial coverage.
- Expertise and technical assistance in geographic information sciences.

Common Data Sources Government Agencies



The National Map Viewer http://nationalmap.gov

Consortium of Federal, State and local partners
Hosted by the USGS



National atlas.gov



broad subject categories that correspond to the chapters of the National Atlas.

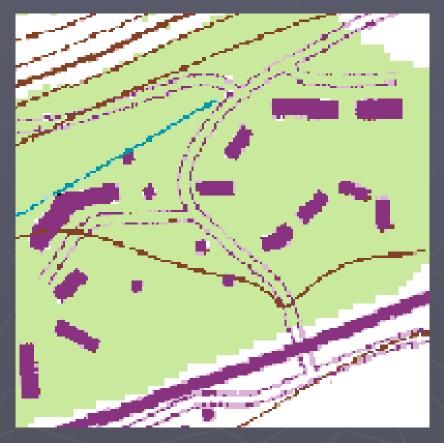
Follow this link for information about downloading raw data.

Click here to go to the North American Atlas raw data download page.

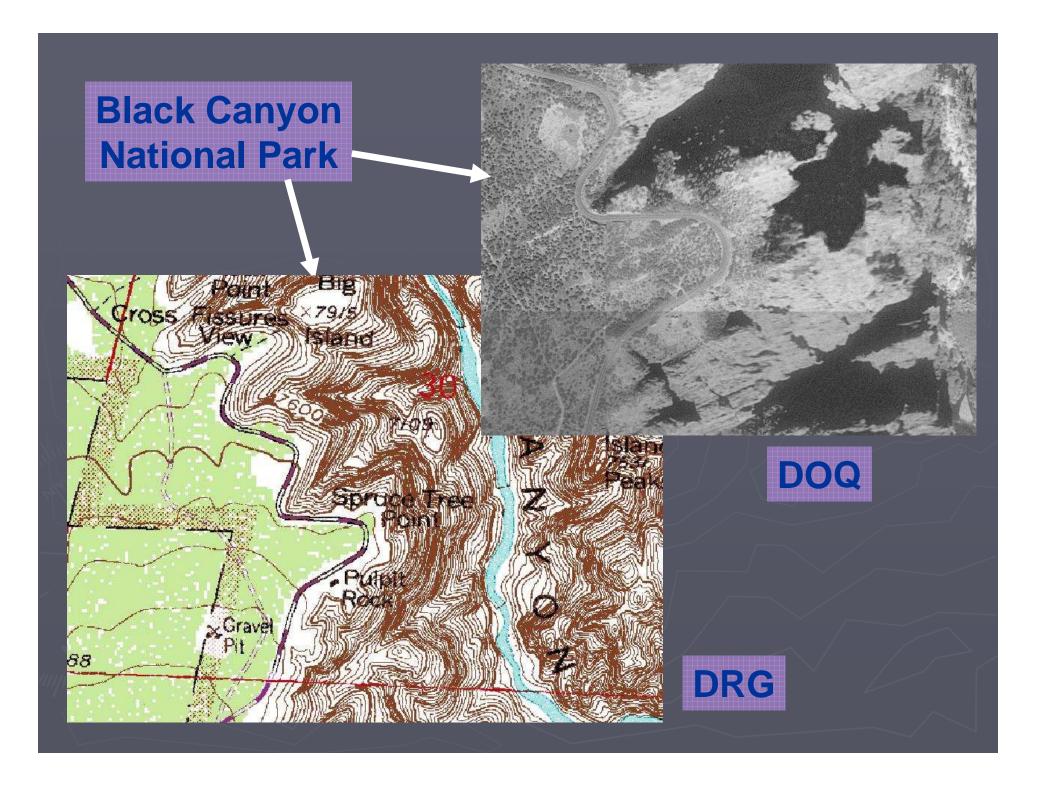
| | Raw Data Download | by Chapter |
|--------------------|------------------------------------|--------------------|
| ◆ Agriculture | ▼ Environment | ◆ People |
| ▼ Biology | ◆ Geology | Transportation |
| ◆ Boundaries | ◆ History | ▼ Water |
| ▼ Climate | ▼ Map Reference | |
| | es, Butterflies, Forests, Invasive | |
| Boundaries: Cong | ressional Districts, Counties, Fed | eral lands, States |
| Climate: Precipita | tion, Hazard Events, Hurricanes, | Sea Temperature |
| Environment: Air | Releases, Hazardous Waste, Tox | ics Release |
| Geology: Earthqua | akes, Landslides, Shaded Relief, \ | /olcanoes |

TerraServer terraserver-usa.com

USGS 1m aerial photographs and 2m topographic maps for viewing and for downloading Into a GIS.



Keystone Colorado



TerraServer Tool

support.esri.com

- Geoprocessing tool provides the user the ability to download imagery, directly to ArcGIS, hosted by the TerraServer Server (http://terraserver.microsoft.com).
- Once the imagery is downloaded to the local drive, it can be used for a variety of applications, industries, or simply as backdrop data in projects or presentations.

Common Data Sources ESRI

- ► ESRI Data & Maps Included With ArcGIS software
- ArcGIS Online
- **▶** ESRI Community Data
 - analyze markets, profile customers, evaluate competitors, and more
- StreetMap





ArcGIS Online

- Ready-to-use content in both 2D and 3D using prebuilt maps, globes, and layers
 - Satellite imagery for the world
 - Political world map
 - Seamless, multi-scale street map
 - Historical world map
- Combine map and globe services from ArcGIS Online with local data
- Embed services in maps and applications that can be shared using ArcReader and ArcGIS Explorer

Where does the data come from?

- ► ESRI has carefully selected a set of high quality data sets from notable commercial and governmental data providers to support the ArcGIS Online services.
- These include National Geographic Society, Tele Atlas, i-cubed, MDA Federal, EastView Cartographic, USGS, NASA, NPS and others.

Data Quality

Key Things to Think About

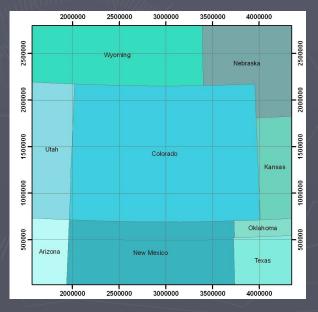
- Accuracy: Are features in the right spot and are their attributes correct?
- Extent: Does the data set cover the area you need?
- Completeness: Is there something missing?
- ► Timeliness: How long ago was the data set created?
- Validity: Does everything look right?
- Convenience: How easy is this data set to use?

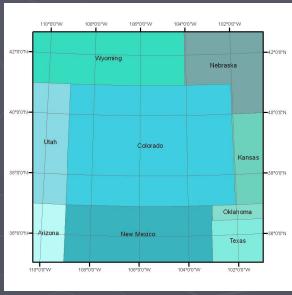
Seven Critical Questions to Ask

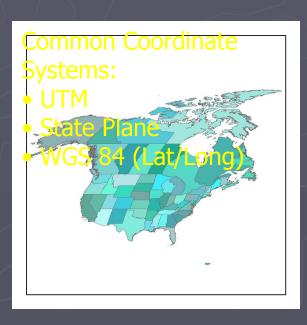
- ► How old are the data?
- ▶ Who created the data?
- ▶ Why were the data created?
- How were the data created?
- ► How detailed are the data?
- ► How reliable are the data and the data provider?
- ▶ Can I use the data?

Projections and Coordinate Systems

- Projection: A method by which the curved surface of the earth is portrayed on a flat surface.
- Coordinate System: A reference system that enables the integration of different spatial data using common locations.

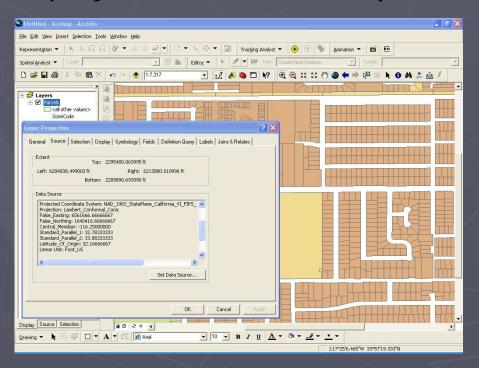






Projections and Coordinate Systems

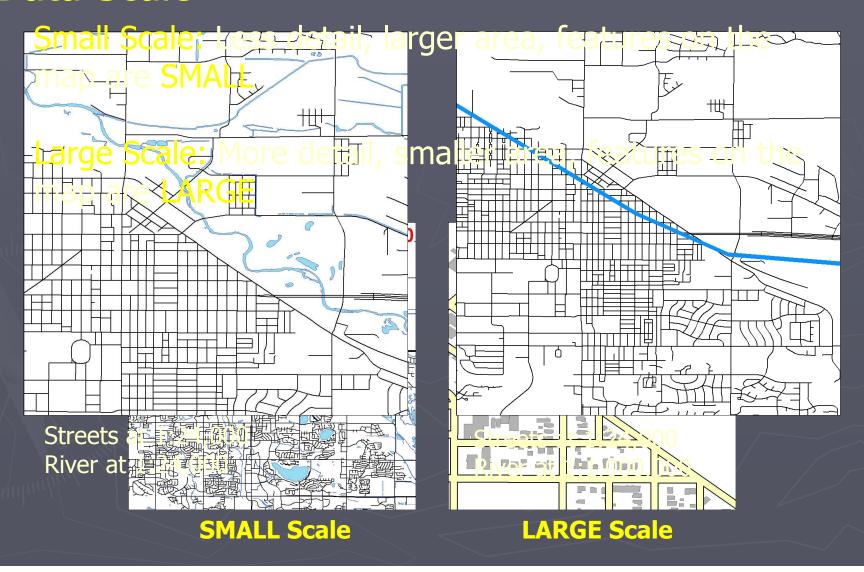
► Most (but not all!) GIS data you can acquire will already have a defined projected coordinate system. If it doesn't, you need to know that in advance and learn how to define a projection for the data yourself.



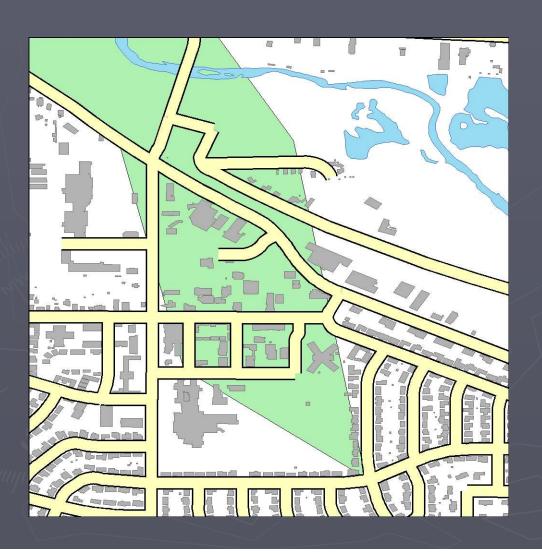
ArcGIS
Projects on
The Fly!

- ► Virtual Campus (\$130)
 - Understanding Map Projections and Coordinate Systems
- ► Technical Workshop (free)
 - Working with Map Projections and Coordinate Systems in ArcGIS

Data Scale



Data Scale



BEWARE FALSE PRECISION!

1:24,000 – Streets, buildings, water

1:100,000 – Mixed-forest vegetation

Usage Restrictions

- ► Can I use the data?
- ► Can I publish the data?
- ► Can I share the data with others?

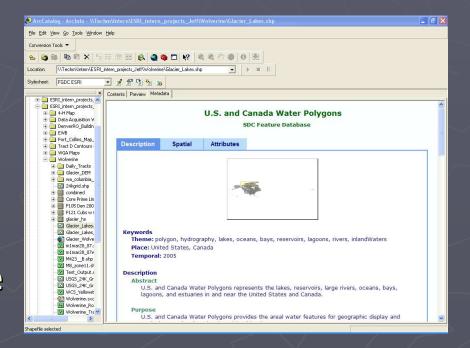


Ask permission and give credit!

Understanding Metadata

Metadata = "Data About the Data"

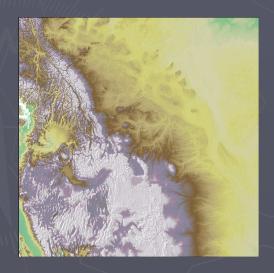
- Use ArcCatalog to review metadata for data sets you already have.
- Look for metadata or other documentation links when you search the Internet
- Ask data providers to ensure that metadata is included.



Spatial Data Types

Digital Data Types





Common Vector Data Formats

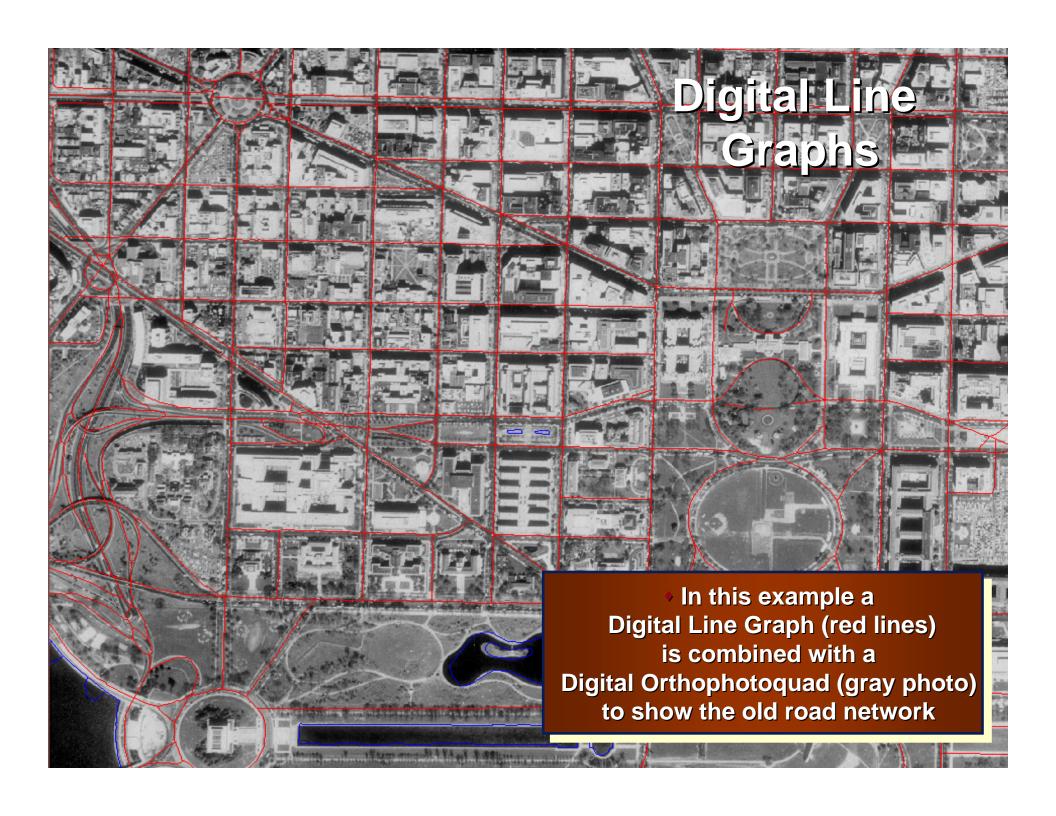
- Shapefile (.shp)
- CAD (.dwg)
- Feature Class (Geodatabase: .gdb)
 - pgdb, file
- ArcInfo Interchange File (.e00) *
- MapInfo Interchange Format (.MIF) *
- * Requires Conversion Using ArcCatalog Tools

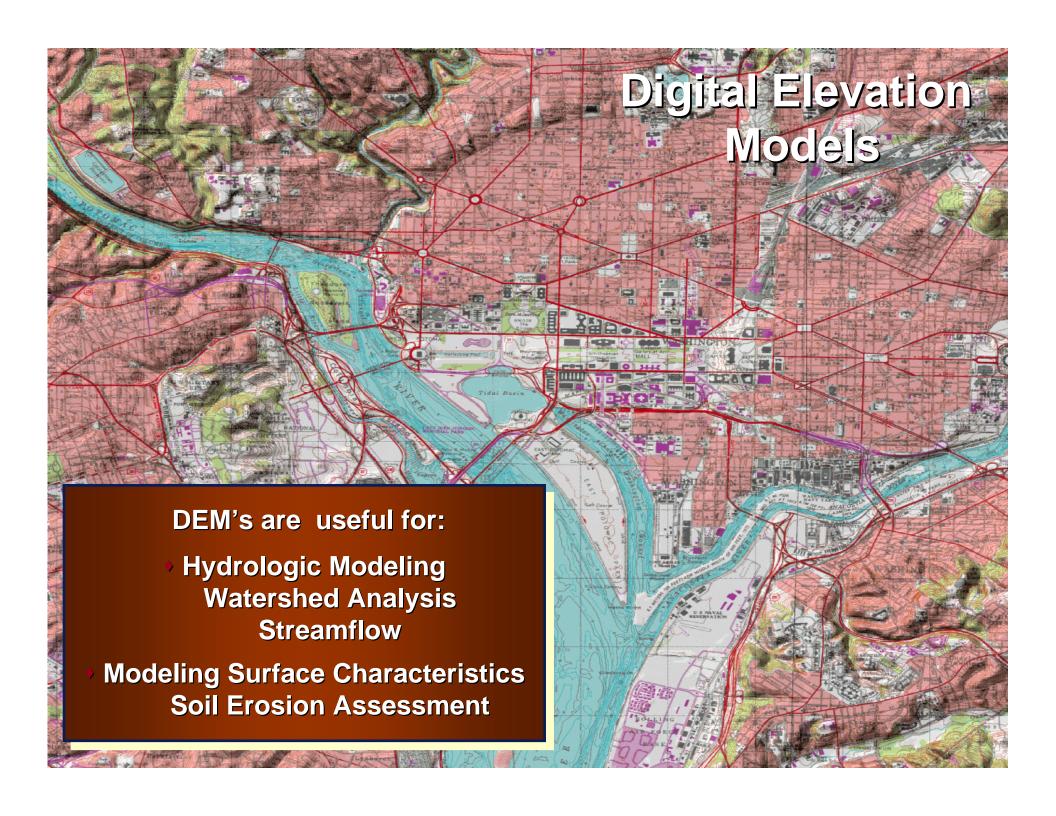
Common Raster Data Formats

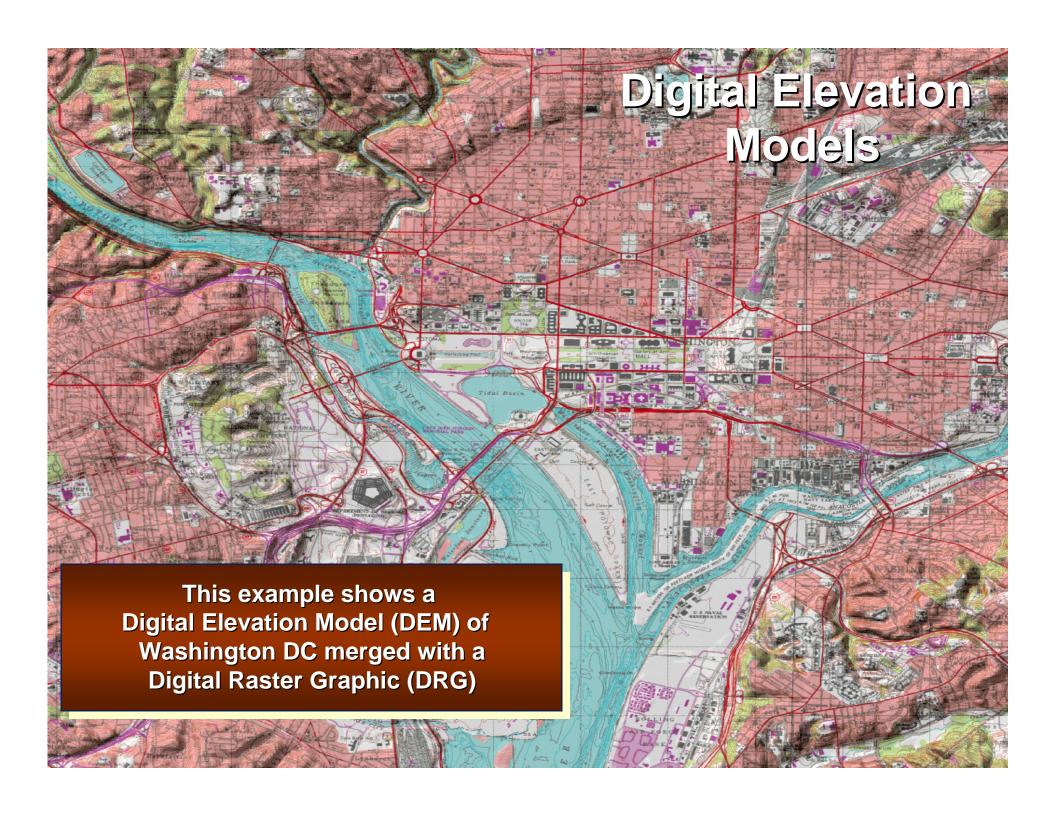
- DEM (Digital Elevation Model)
- DRG (Digital Raster Graphic)
- DLG (Digital Line Graph)
- NED (National Elevation Dataset)
- Georeferenced Image Files (.TIF/.TFW;
 .JPG/.JGW; .BMP/.BPW; .GIF/.GFW) *
- * Requires "World File" for Georeferencing

Rasters

- **DEMs**
- **DRGs**
- **DLGs**
- Aerial Photography
- Satellite Imagery







About NED – National Elevation Dataset

The National Elevation Dataset (NED) is a new raster product assembled by the U.S. Geological Survey.

NED is designed to provide National elevation data in a seamless form with a consistent datum, elevation unit, and projection.

Data corrections were made in the NED assembly process to minimize artifacts, perform edge matching, and fill sliver areas of missing data.

NED has a resolution of one arc-second (approximately 30 meters) for the conterminous United States, Hawaii, and Puerto Rico and a resolution of two arc-seconds for Alaska.

Obtaining NED: http://ned.usgs.gov/ http://seamless.usgs.gov

Imagery ...but why?

- Source of context for GIS
- Fundamental source of geospatial information
- Data source for analysis
- ► Integrate imagery with other geospatial information

History:

1987 as 5-year cyclical program

Original purpose - provide the U.S.G.S. with accurate and cloud-free photographs which would assist them in the creation and revision of USA topographic maps.

Now:

- 5 to 7-year cycle
- Lower 48 states and Hawaii
- One meter resolution
- All photography is cloud-free

National Aerial Photography Program (NAPP)

http://edc.usgs.gov/guides/napp.html



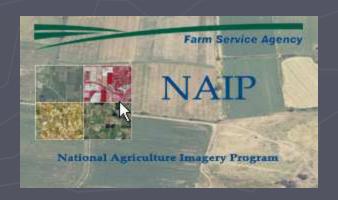
Obtaining Imagery:

http://edcsns17.cr.usgs.gov/EarthExplorer/

National Agriculture Imagery Program

- NAIP acquires imagery during the agricultural growing seasons in the US
- Goal is to enable availability of digital ortho photography within a year of acquisition
- One meter and two meter resolutions available
- ► Hosted by the USDA and Farm Service Agency
- ► Small fee
- http://165.221.201.14/NAIP.html





Satellite imagery is designed to provide repetitive coverage of Earth's land masses at a variety of scales

Free Global Orthorectified
Landsat Data via FTP (some
datasets are fee based)
http://landsat.org/

Earth Resources
Observation and Science
(EROS)

http://edc.usgs.gov/index.html

Digital Globe

(high resolution commercial imagery)

http://www.digitalglobe.com

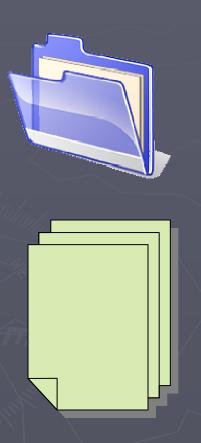
Satellite Imagery Acquisition

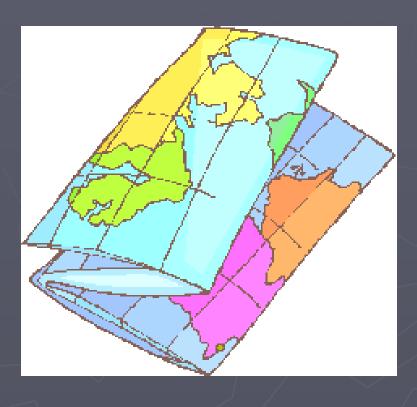




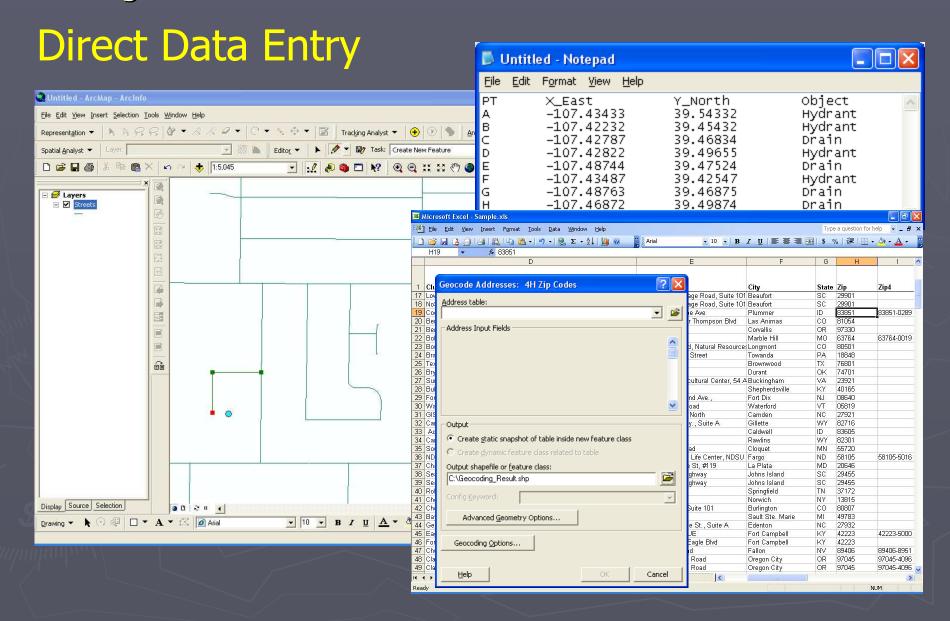
Getting Data Into Your GIS

Digitizing Paper Data





Getting Data Into Your GIS



Getting Data Into Your GIS

GPS





What Kind of Data to Get?

ACME Real Estate – A Case Study

- What do I want the GIS to do?
 Add value by helping clients find the best place to locate their business
- What data does the GIS need in order to do it?
 - Parcels; demographic and income data; zoning; roads and highways; shopping centers, hospitals, schools, etc. locations
- Where can I find these data?
 Local, regional and state agencies;
 federal agencies such as the US
 Census Bureau; GIS user
 communities; data sharing
 consortiums; vendors



What Kind of Data to Get?

A Case Study – Audience Participation is REQUIRED
Who are we? (organization)
What do we do? (mission, business purpose)
Why do we care? (why use GIS)

- What do I want the GIS to do?
- What data does the GIS need in order to do it?
- Where can I find these data?

Demo

- **▶** Download data
- ► Create a file geodatabase
- ► Make a map

Questions?

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